ridge associated with the minutia (*e.g.* Jain et al., "An Identity-Authentication System Using Fingerprint", Proc. IEEE, 85(9), 1365-1388, 1997). Some minutia-based methods implement registration based on only a few minutiae. These methods are usually simple and fast in computation. However, since these methods depend mainly on the local information of a fingerprint, they cannot handle well the influence of fingerprint deformation and may provide an unsatisfied registration.--

A1 c'd

On page 5, please delete the fourth paragraph containing lines 17-31 in its entirety.

On page 6, please delete the first paragraph through the fourth paragraph, containing lines 1-24 in their entirety.

On page 8, please replace the second paragraph containing lines 11-17, with the following rewritten paragraph:

--The invention is a method and system for performing AFIS with various features that contribute to a significant performance improvement to two of the most important aspects of an AFIS: efficiency (fast processing), and reliability (accuracy and robustness to variations in input fingerprints). In particular, these features include a histogram pre-enhancement method, fast smoothing and enhancement method for fingerprint images, a fingerprint-oriented thinning method, a modified Hough transform for fingerprint registration, and an improved matching score computation method.--

A2

On page 8, please replace the fourth paragraph containing lines 22-31 through page 9, lines 1-2, with the following rewritten paragraph:

--As illustrated in the Figure 1, the system includes four modules: a preprocessing module 1, an enhancement module 2, a feature extraction module 3, and a matching module 4.

A3

The preprocessing module 1 pre-enhances an input fingerprint image to remove some noise caused by the fingerprint acquisition device or method 5 and removes the dominant ridge directions. The enhancement module 2 further removes noise and accentuates the desired features of the input fingerprint image so as to provide a higher quality image for the other processing units. The feature extraction module 3 extracts all the fingerprint minutiae that are unique and consistent features of an individual and provides the basis for classification and identification. The matching module 4, implements fingerprint minutiae matching and fingerprint identification and determines whether or not a fingerprint matches a template fingerprint. The template fingerprint may be stored in a database 6.--

A3

On page 9, please replace the second paragraph containing lines 3-11, with the following rewritten paragraphs:

--The preprocessing module 1 includes a histogram transformer 10, dominant ridge direction estimator 11 and coarse segmentation unit 12. The histogram transformer 10 receives finger print images from a finger print sensor/reader 5 or other data scanner or acquirer well known in the art. The dominant ridge direction estimator 11 and coarse segmentation device 12 receive the transformed fingerprint image data. The coarse segmentation 12 outputs the processed coarse segmentation image data to the dominant ridge direction estimator 11, which performs the estimation using the processed coarse segmentation image data and the transformed fingerprint image data.--

A4

On page 12, please replace the second paragraph containing lines 3-18, with the following rewritten paragraph:

--The orientation smoothing and enhancing unit 21 of the enhancement module 2 performs orientation filtering using two convolution processes. A smoothing process and an enhancing process is imposed on every foreground block image. First, the smoothing convolution for all foreground blocks occurs. Then, the foreground blocks are enhanced. The convolution is a directional convolution for a 2-dimensional digital image, and includes a convolution of the filter

A5

(low pass filter for smoothing and high pass filter for enhancing, respectively) with the current block image data by a directional filter. The convolution is implemented by imposing on every pixel within the block the following algorithm:

A5 C.1

$$g(i,j,k) = \sum_{l=1}^{M} f(i + y_{offset}(l), j + x_{offset}(l)) \times h(l)$$

where g(i,j,k) is the output of image intensity at location (i,j); k is index of the dominant direction $\alpha_k = k \times \pi / 16$ of current block for smoothing processing and k is an index of the perpendicular direction of dominant direction of current block for enhancing processing, and h(l) is the low pass filter with 7-tap for smoothing convolution and the high pass filter with 7-tap for enhancing convolution, respectively. The offset coordinates (x_{offset}, y_{offset}) corresponding to discrete direction α_k are listed in Figure 3.--

On page 15, please replace the second paragraph containing lines 12-18, with the following rewritten paragraph:

A6

--While the generalized Hough transform is efficient in computation and works well in many cases, even on partial information of prints, it suffers from an inherent problem that limits its performance. To make the registration accurate, it is desirable to use a relatively small size of lattice bins. This, however, will result in a low maximum evidence count, which means that the alignment will be less reliable. On the contrary, increasing the lattice bin size will lead to poor spatial resolution and thereby low registration accuracy.--

On page 17, please delete the third paragraph in its entirety.